CHELSEA CREEK COMMUNITY BASED COMPARATIVE RISK ASSESSMENT
CHAPTER 2: AMBIENT AIR QUALITY

1. Overview of Ambient Air Quality in the Chelsea Creek Community

Ambient air quality, or the quality of air outdoors, is a concern in every community, especially urban communities that have a high concentration of industries and traffic. Poor ambient air quality can cause short-term and long-term health problems. Air pollution in urban areas consists of a number of chemical compounds that are emitted by a variety of sources. In 1970, the U.S. Congress enacted the Clean Air Act to address many of the problems caused by air pollution. Although there has been much improvement in overall air quality, air pollution continues to cause health problems in urban areas. Air pollution is difficult to monitor because it does not stay in one place. Depending on weather conditions, including wind patterns, temperature, and humidity, and the characteristics of the particular pollutants, air pollution can travel for many miles, affecting air quality far from the pollution source. For example, coal-burning power plants in the mid West contribute to acid rain in New England, and many of the pollutants affecting air quality in Chelsea and East Boston originate in other areas. In the same way, pollution generated in Chelsea and East Boston migrates to neighboring communities, and pollutants generated in Revere, Everett, and Lowell affect the Chelsea Creek neighborhood. Sources located within Chelsea and East Boston are discussed throughout this chapter since the Chelsea Creek communities are the focus of this project.

Chelsea and East Boston have many different sources of ambient air pollution. Chelsea Creek is a highly industrial area with many oil tank farms and active facilities which emit or release a range of pollutants to the atmosphere. Logan Airport is a major source of nitrous oxides, benzene, and other products of fuel combustion such as formaldehyde and particulate matter. Although air traffic contributes heavily to air pollution in the Chelsea Creek community, this project does not specifically address the impacts of the airport. There are other community groups whose focus is the airport, and it was determined that this project would examine other sources of air pollution. However, some consideration of airport related impacts is inevitable. For example, much of the ground traffic through the community is related to the airport. Traffic is discussed in more detail in Chapter 5.

There is a large range of health impacts related to air quality. Pollutants may cause allergy-like symptoms such as eye, nose, and throat irritation or trigger asthma attacks. Exposure to particulates in the air may increase sensitivity to other allergens. Over time, exposure to air pollution can also cause damage to the neurological, reproductive, and respiratory systems of the body and lower immunity to other diseases. Many air toxics are also known or suspected carcinogens, or cancer causing agents (EPA, 1991).

Air quality is regulated on both the federal and State level. The federal EPA establishes air quality requirements through the Clean Air Act, and the Massachusetts Department of

Environmental Protection (MA DEP) conducts on-going monitoring, issues permits, and develops regulations to control emissions and meet these standards. Like all states, the MA DEP must also write "State Implementation Plans" (SIPs) to demonstrate how they will meet the goals of the Clean Air Act. These SIPs must be reviewed and approved by the EPA.

The National Ambient Air Quality Standards (NAAQS) are health-based limits for criteria pollutants, common air pollutants that are present in most communities. These include: carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), ozone (O_3), lead (Pb), and particulate matter (particles) with a diameter less than 10 microns, PM10 (a human hair is about 70 microns in diameter). New regulations to monitor and reduce the levels of much smaller particles, PM2.5, will be implemented over the next few years. PM2.5 has been linked to respiratory disease and heart attacks (Buckeridge, et al., 2001, Peters, et al., 2001). Monitoring stations around the United States measure these pollutants to determine air quality on an on-going basis. States that do not comply with the federal standards for the criteria pollutants must develop plans for improving air quality (State Implementation Plans). States may work to limit new sources of air pollution or reduce existing sources by using new and improved technologies such as filters in order to improve air quality.

Another group of air pollutants is the Hazardous Air Pollutants (HAPs), 188 chemicals that may cause serious health and environmental effects. HAPs include some well-known pollutants such as benzene, which is found in petroleum products, perchloroethylene, product used by some dry cleaners, and dioxins, which are often generated by incineration. HAPs are regulated by permits issued to large industrial sources and standards for vehicle fuel quality and efficiency. Industrial release of HAPs is regulated under the Federal Clean Air Act and enforced by the MA DEP. All major industrial sources such as chemical manufacturing plants or petroleum refineries are required to comply with "maximum achievable control technology" (MACT) as established by the EPA. Industries that emit large amounts (>25 tons per year total) of pollutants are also required to obtain a Title V air permit and report the volume of pollutants released each year. Permit holders pay a permit fee, and these funds go towards air pollution control programs in the state. Some industries that generate lower amounts of HAPs are also required to comply with MACT technology and will be required to obtain Title V permits in 2005.

2. Review of Existing Chelsea and East Boston Ambient Air Quality Information

Criteria Pollutants

The MA DEP has monitored criteria air pollutants in Massachusetts communities at 56 different locations since 1995. Initially, three monitoring stations were located in East Boston and Chelsea. One of the two East Boston monitors, located on Breman Street, is still in place; this monitor measures NO_2, SO_2, CO, and PM. The Chelsea monitor at Powder Horn Hill measured NO_2, SO_2, and O_3 concentrations, and the Visconti Street monitor in East Boston measured CO. Both of these monitoring sites were discontinued in 1999. The historical records from all three monitoring sites show that levels of criteria pollutants other than ozone have consistently been within regulatory limits.

Hazardous Air Pollutants (HAPs)

There is limited monitoring of HAPs in the ambient air because of the difficulty and high cost of measuring the compounds. Monitoring for HAP emissions is conducted by industrial facilities and reported as part of permit requirements. EPA and the DEP also conduct on-site inspections of facilities to ensure compliance with the regulations. The EPA is also working to estimate pollutant concentrations and public exposure using computer models under a National Scale Air Toxics Assessment (NATA) project.

The NATA program combines information from the National Toxics Inventory and Toxics Release Inventory databases which track the emissions of very large industrial sources, area source data including smaller sources such as gas stations and dry cleaners, vehicular emissions based on traffic volume, and wind patterns to calculate annual average ambient concentrations of some of the most hazardous HAPs. Based on the emissions from industrial sources, the amount of on-road and off-road vehicular miles traveled, and the potential for air toxics to linger in the atmosphere or travel long distances, the NATA program models the expected ambient air concentrations and exposure for 33 of the 188 HAPs which have been identified as public health priorities.

The results provide information on the estimated air quality by County as well as estimates of how much air pollution is contributed by motor vehicles, industrial sources, and background levels. This information is useful because it indicates where air control measures may have the greatest effect. For example, in New England, it is projected that emissions from on-road vehicles account for 55 percent of the ambient benzene. 17 percent is from area sources, and 27 percent is from background sources (Background concentrations are from naturally occurring sources or are transported over long distance from other locations). Only 1 percent is from point source emissions. This breakdown varies depending on the compound of concern.

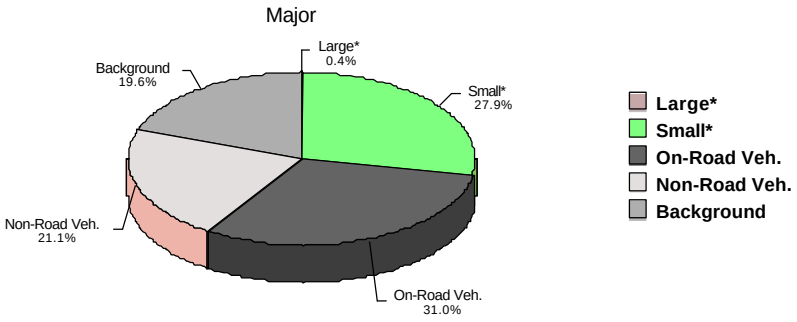
Estimates of ambient concentrations of the 33 HAPs in Suffolk County as calculated by a draft version of NATA are shown in Table 3. Nine compounds (benzene, 1,3-butadiene, carbon tetrachloride, chloroform, chromium, ethylene dibromide, ethylene dichloride, formaldehyde, and methyl chloride) have been identified as the toxics of greatest concern in New England because the ambient concentrations of these pollutants are above the cancer benchmark concentrations (the concentration above which excess cancer risk is a concern) in all six New England states. Table 3 compares the estimated concentrations of these pollutants to the cancer benchmark values; as shown, the residents of Suffolk County may be subject to unacceptable cancer risk from air toxics.

It should be noted that cancer benchmarks are only one part of the impact on public health. There are many other health implications which are not included in this table. For example, the risks of elevated respiratory, cardiac, and immunological disease are not included in the cancer benchmark. NATA indicates that the risk of non-cancer health impacts are also high in Suffolk County. In addition, these risk factors are developed for average individuals. The elderly, the very young, or other populations may be more susceptible to the effects of air

pollution.

It is estimated, based on modeling results, that about 30 percent of the HAPs come from on-road vehicles such as cars, trucks, and buses (see Figure 1). An additional 20 percent are from non-road vehicles including planes, lawn mowers, boats, and construction equipment. The impact of vehicle emissions on air quality is significant given the proximity of both communities to several major roadways, Logan Airport, and Chelsea Creek which is an active port. This assessment is based on the average vehicle miles traveled for Suffolk County; it is likely that modeling underestimates the level of air toxics present in Chelsea and East Boston because of the high concentration of vehicular traffic in the area.

Figure 1 -Contribution to Ambient Air HAP Concentrations
Suffolk County - 1996



* Stationary sources

As shown, the greatest contribution to HAPs in Suffolk County is from on-road and other vehicles. These account for 52.1 percent of HAP concentrations.

3. Analysis of Existing Air Quality Data

There is very little measured air quality data available for specific municipalities, including Chelsea and East Boston. The criteria pollutant monitor in East Boston provides some on-going measure of NO_2, SO_2, CO, but volatile organic compounds, diesel exhaust, and traffic related emissions which are likely to be high are not measured. It is important to note that the Chelsea monitor was located in a residential area away from major truck traffic and industrial emissions. While this placement allows the monitors to represent air quality over a broader area, it also means that the monitors do not capture the worst air quality conditions from the more densely populated and industrial section of Chelsea along the Chelsea Creek. Powder Horn Hill is also a high elevation point where air dispersion of pollutants is likely to be higher than other points in Chelsea. Readings from this monitor therefore may underestimate the pollutant concentrations in surrounding areas.

The Chelsea Creek neighborhood is not unique in its lack of HAPs data. The models described in this chapter are useful for setting priorities on a State wide basis, but may not be adequate to describe the air quality impacts on local communities. The model is designed to identify possible pollution impacts throughout the county and is used for long-term air toxics planning. Since Chelsea and East Boston have heavily traveled highways, an airport, an active port with dense truck and barge traffic, and numerous industrial sites including petroleum storage tanks, the national scale modeling data most likely does not represent the actual conditions to which residents are exposed.

The modeling data is uncertain at a local level because it is a regional scale effort, intended to provide data on regional trends, and because the inventory of sources input into the model are incomplete. Each state determines which facilities the inventory for that state will include, and methodologies vary. For example, the petroleum storage tanks located in Chelsea and East Boston are not included in the 1996 National Toxics Inventory (NTI) data base, but fuel storage facilities in Maine similar to the tanks located in Chelsea and East Boston are included in that state's inventory. Maine reported tank emissions of benzene, ethylbenzene, methyl tert-butyl ether, polycyclic organic matter, toluene, and xylenes. All of these compounds are considered HAPs and impose public health impacts including cancer risks. Both benzene and polycyclic organic matter are on the list of 33 compounds on which the NATA program is based. Although the EPA and the MA DEP are continually working to improve the national toxics inventory of sources, it is very resource and time intensive work. The most recent version of the NTI, based on 1996 data, is available on the web at: http://www.epa.gov/air/data/ntidb.html.

Because ambient air quality estimates are only available on a county-wide basis, it is not possible to do a direct comparison between air quality in the Chelsea Creek area and other communities. However, a comparison of Suffolk County with other parts of the state indicates that Suffolk County is estimated to have considerably higher concentrations of air pollutants than the state overall.

4. Potential Concerns for Public Health and the Environment

Poor air quality is a concern to the residents of the Chelsea Creek area because it can cause public health problems. Toxic air pollutants affect the air we breathe, and pollutants may also settle on soil and water and affect residents through other routes of exposure. For example, children who crawl on soil or play near the Creek may be exposed to air pollutants. Fish and other aquatic species may also be affected by the settling of air pollutants on the water. However, the primary route of exposure is through breathing polluted air. Table 4 shows some of the sources of the criteria pollutants and the potential health effects.

The 33 HAPs that are of greatest concern have a range of health effects. Some of the compounds are known to be cancer-causing. Others may increase the risk of respiratory or neurological damage, and others are "endocrine disruptors", meaning that they affect hormonal systems. The nine air toxics of greatest concern to New England states are listed on Table 5.

Table 4 - Sources and Potential Effects of Criteria Pollutants			
Pollutants	**Sources**	**Potential Health Effects**	**Who is Most Vulnerable?**
Nitrogen Dioxide (NO_2)	High-temperature combustion, (automobiles and power plants)	Lung and respiratory system irritation, lowered resistence to infection	Children, people with respiratory disease including asthma
Sulfur Dioxide (SO_2)	Combustion of fuel containing sulfur (mainly, coal and oil), metal smelting and other industrial processes	Asthma trigger, wheezing, chest tightness, or shortness of breath. Suppressed immune response, aggravation of existing cardiovascular disease	People with cardiovascular disease or chronic lung disease, as well as children and the elderly
Ozone (O_3)	Formed by a reaction between volatile organic compounds and NO_2 in the presence of heat and sunlight	Suppressed immune response, aggravation of pre-existing respiratory diseases such as asthma, decreases in lung function, chest pain and cough. Premature aging of the lungs and/or chronic respiratory illnesses	Outdoor workers, people with pre-existing respiratory disease such as asthma and chronic obstructive lung disease
Particulate Matter (PM)	Fine particulate (PM2.5) is from fuel combustion (motor vehicles, power generation, industrial facilities, residential fireplaces, wood stoves). Coarse particles (PM10) are generally from vehicles traveling on unpaved roads, materials handling, and crushing and grinding operations, as well as windblown dust.	PM2.5 is associated with increased heart and lung disease and aggravation of asthma and other disease. PM10 is primarily associated with the aggravation of respiratory conditions, such as asthma.	Elderly, people with cardiopulmonary disease, such as asthma, and children
Lead (Pb)	Metal processing, smelters, battery manufacturing	Neurological impairments, such as seizures, mental retardation, and behavioral disorders	Children
Carbon Monoxide (CO)	Fuel combustion, vehicle exhaust	Reduces oxygen delivery through body; lowered agility and learning ability.	People who suffer from cardiovascular disease

(EPA National Air Quality: Status and Trends, 1998)

Table 5 - Air Toxics of Greatest Concern in New England		
Pollutants	**Sources**	**Potential Health Effects from Long-Term Exposure**
Benzene	gas stations, auto exhaust, industrial sources	reproductive, immune, and blood system disorders, carcinogen
1,3 Butadiene	motor vehicles, oil refineries, chemical manufacturing	cardiovascular disease, probable carcinogen
Carbon Tetrachlorine	no longer manufactured but still present in background ambient air	liver, kidney damage, decreased fertility, probable carcinogen
Chloroform	solvent, water chlorination by-product, pulp and paper mills	liver and central nervous system disease, probable carcinogen
Chromium	industrial processes, coal and oil burning, catalytic converters and brakes	pulmonary disease, skin sensitivity, gastrointestinal and immune system impacts, carcinogen
Ethylene Dibromide	pesticide, gasoline additive, industrial processes	kidney, liver, and testicular impacts, probable carcinogen
Ethylene Dichloride	plastic and vinyl manufacturing, solvent	liver, kidney, and immune system impacts, probable carcinogen
Formaldehyde	chemical manufacturing, wood preservation, plaster, cosmetics, photography supplies	probable carcinogen, respiratory and reproductive effects
Methyl Chloride	wood, coal, and plastic combustion, manufacturing	liver, kidney, and brain impacts, possible carcinogen

(EPA New England, Air Toxics of Greatest Concern in New England. EPA Web Site)

In addition to the pollutants of greatest concern, there are other chemical releases that are reported to the EPA Toxics Release Inventory (TRI) program. Chemicals reported to the TRI program by industries in Chelsea and East Boston are included in Table 6. The TRI program requires that certain industries with over 10 employees report chemical releases to the environment. Although the TRI database provides valuable information, it is important to note that not all industrial releases are included in this list. It should also be noted that inclusion on this list does not necessarily mean that the release results in an environmental or public health risk to Chelsea and East Boston residents.

Table 6 - Chemicals Reported to the EPA Toxic Release Inventory Air Emissions in Chelsea and East Boston		
Pollutants	**Sources**	**Potential Health Effects from Long Term Exposure**
Antimony compounds	Smelting, coal fired power plants, piping, and batteries	Eye, skin, and lung irritation, stomach pain and ulcers, reproductive and kidney impacts
Copper	Smelting, certain fungicides, industries, sewage	Liver and kidney disease, damage to blood cells, stomach problems, skin rash (Cu at low levels is a necessary micronutrient)
Cyclohexane	Industrial solvent	Nausea, dizziness, respiratory, eye, and skin irritation.
Di(2-ethylhexyl)phthalate	Flexible plastic, children's toys, tubing, vinyl	Stomach irritation, reproductive and developmental effects
ethylbenzene	Gasoline and other fuels, carpet glues, varnishes, and paints	Dizziness, throat and eye irritation, tightening of the chest, liver and kidney damage
Methyl tert-butyl ether (MTBE)	Added to gasoline to produce cleaner burn; runoff from roads, vehicle fumes	Headaches, nausea, dizziness
n-hexane	Industrial solvents, gasoline, quick-drying glues	Muscle weakness, temporary paralysis
Naphthalene	Fossil fuel or wood burning, cigarette smoke, mothballs	Fatigue, lack of appetite, restlessness, pale skin, nausea and stomach problems
Polycyclic aromatic compounds	Fuel burning, vehicle exhaust, asphalt production, grilled food, cigarette smoke	Cancer
Tert-butyl alcohol	Industrial solvent, manufacturing	Dizziness, nausea, skin and eye irritation.
1,2,4-trimethylbenzene	Component of gasoline, paints, cleaners	Headaches, fatigue, skin, eye, and respiratory irritation.
Toluene	Fuel processing, vehicle exhaust, nail polish, paint, industrial processes	Fatigue, confusion, weakness, memory loss, dizziness
Xylene	Petroleum, vehicle exhaust, industrial solvents, paint	Headaches, loss of balance and coordination, eye, skin, and lung irritation

Note: There is a map associated with this chapter - download the map entitled: Stationary Air Pollution Sources

5. GIS Maps of Available Air Quality and Information

The attached map shows some of the largest sources of HAPs in the Chelsea Creek community as well as the major road ways which border the neighborhoods. More information on truck and traffic patterns is available in Chapter 5.

6. Current Air Quality Projects or Activities in Chelsea/East Boston

On a national level, the EPA is working to improve air quality by issuing technology standards for both industrial sources and mobile sources of air pollutants. Overall, air quality has improved. Since 1988, there has been a 74 percent decrease in air toxics released by large industries in New England. However, since the industries located in Chelsea and East Boston are not included in this category, this statistic does not necessarily reflect changes in air quality in this community.

There is also a national program to help residents protect themselves from the health effects of ozone. The Air Quality Index program rates air quality on a scale of hazardous to good every day during the summer when ozone levels are highest. The daily rating is reported in newspapers and the radio and is also available on the internet at www.epa.gov/airnow/where. The Index includes guidelines of what activities are safe and if sensitive individuals such as those with asthma or respiratory disease should avoid outdoor activities.

New MACT standards will be coming out in the next few years which will further reduce emissions from industries. In addition, EPA-New England is working to bring petroleum companies together to review existing technologies and community concerns and determine ways to reduce emissions. The Chelsea Creek Action Group and the Waterfront Association of Chelsea have also been working to reduce emissions from the fuel storage tanks.

Chelsea Green Space and Recreation Committee has been working to increase and improve urban parks along Chelsea Creek. In addition to aesthetic considerations, increased green space has a positive impact on air quality (see Open Space chapter). On-going community involvement in airport planning has also focused on air quality concerns.

The EPA and DEP are working to improve the NATA models to ensure that they provide an accurate picture of air quality conditions in each county. There are also on-going monitoring efforts to evaluate the model and determine if modeling results over or under estimate actual conditions.

7. Greatest Air Quality Concerns for Chelsea and East Boston Residents

The greatest concern regarding air quality is the impact that air toxics may have on the health of the community. Many of the HAPs of greatest concern in Suffolk County are likely to be present in high concentrations in Chelsea and East Boston because of the high traffic volume. However, without air monitoring data, the extent to which the public health risk in the community is elevated and which of the HAPs is of greatest concern is unknown.

Pulmonary diseases including asthma, lung cancer, and chronic obstructive pulmonary disease (COPD) are related to air quality. For more on respiratory diseases, see Chapter 4. There are other potential health effects associated with air pollutants as well, but a detailed epidemiological study would be necessary to determine if health outcomes in the Chelsea Creek communities differ from other parts of Boston.

8. Recommendations to Address the Greatest Air Quality Problems

The highest priorities for the Chelsea Creek residents include improving the available air quality data for their community and reducing the sources of pollutants in Chelsea and East Boston. Some recommended steps towards these goals are:

Community Actions

- Work with the Massachusetts Office of Technical Assistance to devise ways to reduce emissions from fuel storage tanks.
- Distribute information on vehicle emissions and idling to bus, truck, and car drivers and work with police to enforce laws.
- Encourage residents to use public transportation to reduce vehicle use.
- Revise and enforce existing truck routes to reduce traffic in residential areas.
- Work to include tank farms on Massachusetts National Toxics Inventory (NTI) list.
- Encourage voluntary reduction in emissions from industries and individuals.

Longer-Term Priorities

- Replace the criteria pollutant monitor which was removed from Chelsea in 1999.
- Implement new monitoring strategies to collect data on local air quality.
- Conduct fine particulate sampling in the heavily trafficked Chelsea Creek area to determine the extent of diesel truck traffic impacts on air quality.
- Determine the HAPs of greatest concern in the community and conduct sampling around the Chelsea Creek neighborhoods.
- Conduct diesel metabolite testing on residents similar to study conducted in West Harlem to demonstrate the impact of high traffic volume on residents.
- Work with Federal, State, and Local agencies to enforce ordinances and regulations.

Personal Actions

- Use public transportation as much as possible and car pool to reduce vehicle usage.
- Turn off car engines when waiting for more than five minutes.
- Check www.airbeat.org or local newspapers for air quality alerts during the summer to see if conditions are safe for outdoor activities.

9. Contact List

The following is a list of government agencies and community organizations which are involved in the management or monitoring of air quality in the Chelsea Creek community.

U.S. EPA New England
Office of Environmental Stewardship, Enforcement Unit, Deborah Brown . (617) 918-1706
Air Permits Program Unit, Susan Lancey ..... (617) 918-1656
MA State Unit, David Webster ..... (617) 918-1791

Massachusetts State / New England Programs
New England States For Coordinated Air Use Management, Ginger Lawrence (617) 367-8540
MA DEP, Air Quality Planning and Evaluation, Azin Kavian ..... (617) 574-6801

Community and Municipal Organizations
Chelsea Health and Human Services, Luis Prado ..... (617) 889-8266
Chelsea Creek Action Group, Roseann Bongiovanni ..... (617) 889-6080

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Peters, Annette, Douglas W. Dockery, James E. Muller, Murray A. Mittleman. Increased Particulate Air Pollution and the Triggering of Myocardial Infarction. *Circulation,* 2001: 103:2810.

U.S. EPA. Evaluating Exposures to Toxic Air Pollutants: A Citizen's Guide. March 1991. EPA 450/3-90-023.

http://www.epa.gov/region1/eco/airtox/index.html - The EPA-New England website on air toxics provides information on specific compounds of concern and projected concentrations of air pollutants.

Other Publications:

Friedman, Michael S., Kenneth E. Powell, Lori Hutwagner, LeRoy M. Graham, Gerald W. Teague. Impact of Changes in Transportation and Commuting Behaviors During the 1996 Summer Olympic Games in Atlanta on Air Quality and Childhood Asthma. *Journal of the American Medical Association.* February 2001. Vol. 285(7): 897-905.

U.S. EPA. Smog - Who Does it Hurt. July 1999. EPA-452/K-99-001.
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